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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35.U.S.C. 371

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INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/02015	June 20, 2000	June 28, 1999

TITLE OF INVENTION METHOD AND DEVICE FOR DETECTING THE DIRECTION OF MOVEMENT OF A MOBILE DATA MEMORY, PARTICULARLY IN AN IDENTIFICATION

APPLICANT(S) FOR DO/EO/US WOLFGANG PUSCH, MARTIN SCHIEFER, and PETER-ERNST VEITH

Applicant herewith submits to the United States Designated /Elected Office (DO/EO/US) the following items and other information:

1. ☑ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(I).
4. ☑ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☑ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☑ has been transmitted by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☑ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. [ ] A copy of the International Search Report (PCT/ISA/210)
   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).
   b. [ ] have been transmitted by the International Bureau
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. ☑ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☑ A copy of the International Preliminary Examination Report (PCT/IPEA/409)
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☑ A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. ☑ A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [ ] Other items or information:
    a. ☑ a copy of the International Search Report (PCT/ISA/210)
    b. ☑ a copy of the International Preliminary Examination Report (PCT/IPEA/409)

Comparison document; English and German versions of application; cover page of PCT international application PCT/DE00/02015; formal drawings (Figs. 1-3); postcard; IDS (two copies) PTO Form 1449; cited references; and check in the amount of $740.00.

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/02015 10/009721	June 20, 2000	June 28, 1999

7. [ ] The following fees are submitted:

CALCULATIONS PTO USE ONLY

Basic National Fee (37 CFR 1.492(a)(1)-(5):

Neither international preliminary examination fee (37 CFR 1.482)
Nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO (1.492(a)(3)) $1,040

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO (1.492(a)(5) $890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO(1.492(a)(2)) $740.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) (1.492(a)(1)) $710.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $ 100.00

ENTER APPROPRIATE BASIC FEE AMOUNT				= $	740
Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 C.F.R. 1.492)(e)).				$	
Claims	**Number Filed**	**Number Extra**	**Rate**	$	
Total Claims	14 -20=	0	X $ 18.00	$	0
Independent Claims	1 -3=	0	X $ 84.00	$	0
Multiple dependent claim(s) (if applicable)			+ $280.00	$	
TOTAL OF ABOVE CALCULATIONS				= $	740
Reduction by ½ for filing by small entity, if applicable.				$	
SUBTOTAL				= $	740
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE				= $	740
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +				$	
TOTAL FEES ENCLOSED				= $	740
				Amt. refunded	$
				charged	$

a. [✓] A check in the amount of $ 740.00 to cover the above fees is enclosed.

b. [ ] Please charge our Deposit Account No. 02-4377 in amount of $_____ to cover the above fees. A copy of this sheet is enclosed.

c. [✓] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4377. A copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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12/13/01
Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Pusch et al.
Serial No.	:	To Be Assigned
Filed	:	Herewith
For	:	METHOD AND DEVICE FOR DETECTING THE DIRECTION OF MOVEMENT OF A MOBILE DATA MEMORY, PARTICULARLY IN AN IDENTIFICATION SYSTEM
Examiner	:	To Be Assigned
Group Art Unit	:	To Be Assigned

Assistant Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

Sir:

Kindly amend the above-identified application before examination as follows:

IN THE SPECIFICATION:

Please substitute the originally-filed specification with the Substitute Specification which is enclosed herewith. A comparison document showing the differences between the translation of the originally-filed specification and the enclosed Substitute Specification is also enclosed herewith.

IN THE CLAIMS:

Please amend original claims 1-14 as follows:

1. (Amended) A method for detecting the direction of movement of a mobile data memory along a movement path, comprising detecting data signals of a mobile data memory in at least two different receiving locations along the movement path, comparing changes in the data signals at the receiving locations, and defining therefrom an indicator for the direction of movement of a mobile data memory.

2. (Amended) The method according to claim 1, wherein the indicator is defined by comparison of changes in received field strengths of data signals at the receiving locations.

3. (Amended) The method according to claim 2, wherein weighting factors are derived by comparison of the received field strengths of the data signals at the receiving locations in such a way that a higher or lower weighting factor is allocated to a data signal with a stronger or weaker received field strength.

4. (Amended) The method according to claim 3, wherein the indicator is defined by evaluation of the data signals weighted with the weighting factors.

5. (Amended) The method according to claim 1, further comprising defining the indicator by comparison of the data signals' type at the receiving locations.

6. (Amended) The method according to claim 1, further comprising decoding the received data signals, and defining their logical content.

7. (Amended) The method according to claim 6, wherein the indicator is defined by evaluation of a temporal sequence of the logical content of the data signals at the receiving locations.

8. (Amended) The method according to claim 6, wherein the logical content of the data signals is allocated to mobile data memories.

9. (Amended) A device for carrying out the method according to claim 1, comprising an adaptive receiver having at least two antennas for the reception of data signals which are disposed along a movement path of a mobile data memory, and an evaluation unit which is connected to the antennas and which defines an indicator for the direction of movement of a mobile data memory from the data signals.

10. (Amended) The device according to claim 9, further comprising a transceiver for two-way exchange of data signals with mobile data memories and which contains the adaptive receiver device.

11. (Amended) The device according to claim 9, wherein the antennas have antenna radiation diagrams which are aligned and focused along the movement path of mobile data memories.

12. (Amended) The device according to claim 11, wherein the radiation diagrams have an overlap in relation to one another which is as limited as possible.

13. (Amended) The use of the method according to claim 1 in an identification system having a mobile data memory attached to mobile goods, whereby data characterizing the respective goods are stored in the mobile data memory.

14. (Amended) The device according to claim 9 for use in an identification system having a mobile data memory attached to mobile goods, whereby data characterizing the respective goods are stored in the mobile data memory.

REMARKS

By this Preliminary Amendment, applicants amend originally-filed claims 1-14 to comply with the U.S. Patent and Trademark Office practice and standards. No new matter has been added to the application. Amendments to the claims do not address any issues of patentability, and the amended claims are provided to place the application in better condition for allowance.

Likewise, the amendments to the specification are provided to correct grammatical and syntactical errors in the originally filed application. No new matter has been introduced into the application.

The amendments to the "Claims" are reflected in the attached "Version With Marked Changes Made."

Favorable consideration on the merits is respectfully requested.

Respectfully submitted,

Dated: December 13, 2001

By: _____
Bradley B. Geist
Reg. No. 27,551

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Version With Marked Changes Made

WE CLAIM:

~~1. A method for detecting the direction of movement of a mobile data memory (MDS) along a movement path (2), characterized in that~~

1. ~~(a)~~ A method for detecting the direction of movement of a mobile data memory ~~(MDS) along a movement path (2), characterized in that~~along a movement path, comprising detecting data signals ~~(fca...fcd)~~ of a mobile data memory ~~(MDS) are detected~~ in at least two different receiving locations ~~(Pa...Pd)~~ along the movement path ~~(2)~~, comparing changes in the data signals ~~(fca...fcd) are compared~~ at the receiving locations ~~(Pa...Pd), and therefrom~~, and defining therefrom an indicator ~~an indicator (V) is defined~~ for the direction of movement of a mobile data memory ~~(MDS).~~.

~~(b) changes in the data signals (fca...fcd) are compared at the receiving locations (Pa...Pd), and therefrom~~

~~(c) an indicator (V) is defined for the direction of movement of a mobile data memory (MDS).~~

2. The method ~~as claimed in~~according to claim 1, ~~characterized in that~~wherein the indicator ~~(V) for the direction of movement~~ is defined ~~through~~by comparison of changes in ~~the~~ received field strengths ~~(Ca...Cd)~~ of data signals ~~(fca...fcd)~~ at the receiving locations ~~(Pa...Pd)~~.

~~3. The method as claimed in claim 1 or 2, characterized in that through~~

(a) comparison of the received field strengths (Ca...Cd) of the data signals (fca...fcd) at the receiving locations (Pa...Pd), weighting factors (ga...gd) are derived in such a way that

3. (b) The method according to claim 2, wherein weighting factors are derived by comparison of the received field strengths (Ca...Cd) of the data signals (fca...fcd) of the data signals at the receiving locations (Pa...Pd), weighting factors (ga...gd) are derived in such a way thatin such a way that a higher or lower weighting factor (ga...gd) is allocated (fga...fgd) to a data signal (fca...fcd) with a stronger or weaker received field strength (Ca...Cd).

4. The method as claimed inaccording to claim 3, characterized in thatwherein the indicator (V) for the direction of movement is defined throughby evaluation of the data signals (fga...fgd) weighted with the weighting factors (ga...gd).

5. The method as claimed in one of the preceding claims, characterized in thataccording to claim 1, further comprising defining the indicator (V) for the direction of movement is defined throughby comparison of the data signals' type of data signals (fca...fcd) at the receiving locations (Pa...Pd).

6. The method as claimed in one of the preceding claims, characterized in thataccording to claim 1, further comprising decoding the received data signals (fca...fcd) are decoded, and defining their logical content defined.

7. The method as claimed inaccording to claim 6, characterized in thatwherein the indicator (V) for the direction of movement is defined throughby

evaluation of ~~the~~a temporal sequence of the logical content of the data signals at the receiving locations ~~(Pa...Pd)~~.

8. The method ~~as claimed in~~according to claim ~~6 or 7, characterized in that~~6, wherein the logical content of the data signals ~~(fca...fcd)~~ is allocated to mobile data memories ~~(MDS)~~.

~~9. A device to carry out the method as claimed in one of the preceding claims, characterized by an adaptive receiver device (3) with~~

~~(a) at least two antennas (a1...d1) at least for the reception of data signals (fza...fzd), which are disposed along the movement path (2) of a mobile data memory (MDS), and with~~

9. ~~(b)~~ A device for carrying out the method according to claim 1, comprising an adaptive receiver having at least two antennas~~at least two antennas (a1...d1) at least for the reception of data signals (fza...fzd), which are disposed along the movement path (2) of a mobile data memory (MDS), and with~~a movement path of a mobile data memory, and an evaluation unit ~~(31),~~ which is connected to the antennas ~~(a1...d1)~~ and which defines an indicator ~~(V)~~ for the direction of movement of a mobile data memory ~~(MDS)~~ from the data signals ~~(fza...fzd)~~.

10. The device ~~as claimed in~~according to claim 9, ~~characterized~~further ~~by~~comprising a transceiver ~~device~~ for two--way exchange of data signals with mobile data memories ~~(MDS),~~and which contains the adaptive receiver device ~~(3)~~.

11. The device ~~as claimed in~~according to claim ~~9 or 10, characterized by~~9, wherein the antennas ~~(a1...d1)~~have ~~whose~~antenna radiation diagrams which are

aligned and focused ~~as accurately as possible~~ along the movement path ~~(2)~~ of mobile data memories ~~(MDS)~~.

12. The device ~~as claimed in~~according to claim 11, ~~characterized in that~~wherein the radiation diagrams ~~of the antennas (a1...d1)~~ have an overlap in relation to one another which is as limited as possible.

13. The use of ~~a~~the method ~~as claimed in one of claims~~according to claim 1 ~~to~~ ~~8~~ in an identification system ~~which at least has~~having a mobile data ~~memories (MDS)~~memory attached to mobile goods, whereby data characterizing the respective goods are stored in ~~a~~the mobile data memory ~~(MDS)~~.

14. The ~~use of a~~ device ~~as claimed in one of claims~~according to claim 9 ~~to~~for ~~12~~use in an identification system ~~which at least has~~having a mobile data ~~memories (MDS)~~memory attached to mobile goods, whereby data characterizing the respective goods are stored in ~~a~~the mobile data memory ~~(MDS)~~.

BAKER BOTTS L.L.P.

30 ROCKEFELLER PLAZA

NEW YORK, NEW YORK 10112

TO ALL WHOM IT MAY CONCERN:

Be it known that WE, WOLFGANG PUSCH, MARTIN SCHIEFER, and PETER-ERNST VEITH, all citizens of Austria, whose post office addresses are Getreidemarkt 13/35, A-1060 Wien, Austria; Birkengasse 33, a-3100 St. Pölten, Austria; and Peter-Jordan-Str. 88/6, A-1190, Wien, Austria; respectively, have invented an improvement in:

METHOD AND DEVICE FOR DETECTING THE DIRECTION OF MOVEMENT OF A MOBILE DATA MEMORY, PARTICULARLY IN AN IDENTIFICATION SYSTEM

of which the following is a

SUBSTITUTE SPECIFICATION

FIELD OF THE INVENTION

[0001] The invention relates to a method and device by which the direction of movement of a mobile data memory can be detected in a contactless and simplified manner in an identification system.

BACKGROUND OF THE INVENTION

[0002] In stationary production and conveyance systems, a multiplicity of objects or goods must normally be moved as quickly and freely as possible with the aid of technical conveyance devices, e.g., conveyor belts. The objects may be of varying types, e.g.,

packages in a dispatch device, assembly parts in a production system, items of luggage in a conveyance system and many more. It is normally necessary to detect quickly and easily the type and condition of the objects currently at specific locations in the system. To do this, the objects are provided with mobile data memories which contain data characterizing the type and current condition of the objects, and stationary communications devices are placed at specific locations in the system which are usually connected to a central data processing device. The communications devices enable contactless reception of data signals which are transmitted by the mobile data memories usually via a radio-based data transmission path. Depending on the system type, the communications devices may be a receiver device, or a transceiver device which enables two-way exchange of data signals with the mobile data memories.

[0003] A system for contactless detection of data signals of the type described above is also referred to as an identification system. If, for example, in a production process, objects provided with mobile data memories are moved into the vicinity of a selected location, a proximally located receiver or transceiver device can detect data signals from the mobile data memories of those objects which are currently located within its detection area, in a contactless manner. The data contained in these data signals can be decoded with the aid of a higher-order central data processing device and evaluated for different purposes, e.g., to track the movement of the objects provided with the mobile data memories, and depending thereon, to control operating means of the relevant technical system. The data can also be updated and then sent back to the mobile data memories in the form of data signals.

[0004] In technical systems, individual goods may have different directions of movement in the flow of goods. In practice, goods may, under certain circumstances, be moved by one or more conveyance devices in one direction or in the opposite direction. Thus, goods may, at a specific location (e.g., at a gate), move into a production device, or leave this device at the same location after processing. If the direction of movement of individual goods can be detected at such locations, further parts of the production device can be controlled with this information.

[0005] The direction of movement of goods has hitherto normally been determined in technical systems with the aid of light barriers, switching means and the like. This is expensive since on conveyance means additional electromechanical components need to be attached which serve exclusively to detect the direction of movement. A further disadvantage is that it is possible only to detect the direction of movement of a flow of goods which are generally similar. A particular problem occurs if the direction of movement of individual goods is to be detected since in conventional systems it is not immediately possible to detect simultaneously the type and current condition of individual goods and their direction of movement, and to relate them to one another.

SUMMARY OF THE INVENTION

[0006] The object of the present invention is to provide a method and a device with which the direction of movement of mobile data memories can be detected in a contactless manner and, as far as possible, without an additional outlay in terms of technical components. In the method according to the present invention, in at least two different receiving locations along a movement path of a mobile data memory, data signals of said memory and changes in these data signals are detected. An indicator for

the direction of movement of the mobile data memory can be defined from a comparison of these parameters.

[0007] An advantage of the method according to the present invention is that the direction of movement is detected exclusively using data signals which the mobile data memories transmit for the purpose of communicating with a receiver or transceiver device. Thus the data signals can be used in a dual manner, i.e., as a carrier for data, and as a medium for identification of a direction of movement. If data signals of this type are received in at least two receiving locations positioned along the movement path of the data memories, the direction of movement of the data memories can be detected from a comparison of changes in these data signals. No additional separate components, e.g., light barriers and the like, are thus required. Instead, the direction of movement can be detected in addition to the data exchange between mobile data memories and a receiver or transceiver device in a contactless, all-electronic manner.

[0008] In one preferred embodiment of the method according to the present invention, the indicator for the direction of movement is defined through a comparison of changes in the received field strengths of a data signal at the receiving locations. The data content of the data signal is irrelevant. Instead, by comparing, for example, the increases and decreases in the received field strengths of the data signal in at least two receiving locations, it is possible to detect whether the mobile data memory which transmits this data signal is moving away from or toward a receiving location. Following evaluation of the received field strengths, the data signal can be decoded in a conventional manner and the data content can be further processed.

[0009] In another preferred embodiment of the method according to the present invention, weighting factors are derived through a comparison of the received field strengths of the data signals at the receiving locations in such a way that a high or low weighting factor is allocated to a data signal which has a strong or weak received field strength. The result is that data signals from those receiving locations which are close to the mobile data memory and thus have high reception quality are further amplified, whereas the data signals from receiving locations which are further away from the mobile data memory and thus have lower reception quality are further attenuated. The signal-to-noise ratio, and therefore reception quality are thus improved.

[0010] The adaptation of the data signals by means of weighting can be exploited in two ways. First, in a downstream evaluation unit, using all instantaneously available data signals from the individual receiving locations and taking into account their weighting, an optimum summation data signal can be synthesized which has the highest possible signal-to-noise ratio and can thus be decoded as far as possible without errors. Second, the indicator for the direction of movement can also be advantageously defined through evaluation of the data signals and weighted with the weighting factors, i.e., adapted. Thus, the selectivity of the direction of movement detection can thereby be improved.

[0011] In a further preferred embodiment of the method according to the present invention, the indicator for the direction of movement can be defined through a comparison of the type of data signals. Accordingly, a receiver or transceiver device can evaluate whether the data signals received at the receiving locations are external signals or user data signals. By tracking the reception of a data signal at the individual receiving locations, its type having been identified in particular as a user data signal, it is similarly

possible to detect whether an associated mobile data memory is moving away from or toward a receiving location. In this case a data signal, after its evaluation for the purpose of identification of the direction of movement, can be decoded in a conventional manner and its data content can be further processed.

[0012] In another preferred embodiment the method according to the present invention, data signals which are received at different receiving locations are not evaluated for the purpose of identification of the direction of movement until they have been decoded and their logical content defined. This embodiment offers the advantage that no different conditions of the data signals need to be used to detect the direction of movement and to process the logical content of the data signals. Instead, the data signals received at the receiving locations are decoded in a conventional manner and are then available for further processing, e.g., in a binary data processing unit. As one of these processing steps, the indicator for the direction of movement can then be defined in the data processing unit through evaluation, in particular, of the temporal sequence in which individual data signals have been received at the receiving location and through comparison of their content. If, for example, a data signal, which can be allocated following decoding to a specific mobile data memory, is successively received at different receiving locations, it is possible to detect from the temporal sequence of this reception whether the mobile data memory which transmits this data signal is moving away from or toward a receiving location.

[0013] The aforesaid embodiment of the method according to the present invention offers the further advantage that the logical content of data signals can be uniquely allocated to individual mobile data memories following decoding. As a result, it is possible to detect

the direction of movement of a plurality of mobile data memories which successively or virtually simultaneously pass the receiving locations along the movement path.

[0014] Furthermore, an indicator for the direction of movement can also be defined by simultaneously using a plurality of the above-described methods. The data signals can thus advantageously be evaluated simultaneously taking into account not only their field strength but also their logical data content which is available following decoding.

[0015] A preferred device for carrying out the method according to the present invention comprises an adaptive receiver which has at least two antennas which are disposed along the movement path of a mobile data memory and enable at least the reception of data signals. The antennas are connected to an evaluation unit which defines an indicator for the direction of movement of a mobile data memory from the received data signals. A transceiver device, which contains the adaptive receiver device as a component, is advantageously provided for two-way exchange of data signals with mobile data memories.

[0016] The method according to the invention and the device suitable for carrying it out can be used particularly advantageously in an identification system which has at least mobile data memories fitted to mobile goods, and in which data characterizing the relevant goods are stored in a mobile data memory.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The present invention is described in greater detail below in connection with the following drawings, in which:

Figure 1 illustrates a first device, which is particularly suited to carrying out the method according to the invention, and in which a mobile data memory enters the detection area;

Figure 2a illustrates another device suited to carrying out the method according to the invention supplement to the design shown in Figure 1 in which adaptation of the data signals received at different receiving locations is additionally carried out, and in which a mobile data memory, by way of example, similarly enters the detection area; and

Figure 2b generally corresponds to Figure 2a, however, unlike Figure 2a, the mobile data memory has partially passed through the detection area.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The block diagram in Figure 1 shows, on the left-hand side, a typical mobile data memory MDS, which moves along a movement path 2 in a first direction V1, i.e. on the page plane from top to bottom. The radiation area of the data signals transmitted by the mobile data memory MDS is represented in Figure 1 by a curved field line Smds. The received field strength of the data signals is intended to have a matching value along this field line. Corresponding field lines could be drawn in the form of rings inside or outside the field line Smds. These field lines would then represent higher or lower received field strength values. However, additional field lines of this type are not shown in the Figure for the sake of simplicity.

[0019] Figure 1 furthermore shows, on the right-hand side, a receiver device 3 which contains four parallel channels 3a-3d. Each channel contains an antenna a1-d1, which is disposed at a receiving location Pa-Pd along the movement path 2. The reception ranges of the antennas a1-d1 are similarly represented in Figure 1 by bubble-shaped field lines

Ca-Cd. The sum of these "reception lobes" Ca-Cd forms the detection area of the device 3. The arrangement shown in Figure 1 can also be referred to as an "adaptive antenna." Here, a specific number of equivalent antennas disposed along a movement path are interconnected in one line. Their "reception lobes" Ca-Cd are aligned and focused as accurately as possible and have a minimal overlap in relation to one another.

[0020] The antennas a1-d1 receive the data signals transmitted by the mobile data memory MDS in the form of radio-frequency antenna signals fca-fzd. These signals are in each case fed to a receiver a2-d2, which forms intermediate-frequency antenna signals fza-fzd therefrom. These signals are fed to a processing unit 32, which synthesizes a processed summation data signal fs. This signal is finally decrypted in a demodulator 33 and is then available as a decoded, preferably digital, data stream fd for further processing. Digital computing units suitable for this purpose are not shown further in the Figure for the sake of simplicity.

[0021] In Figure 1, the data signals of the mobile data memory MDS are detected in the form of the four antenna signals fza-fzd. The reception differs at the four receiving locations Pa-Pd due to the relative position of the mobile data memory MDS in relation to the individual antennas a1-d1. The reception is subject to changes due to the movement of the mobile data memory MDS along the movement path 2. If these changes in the reception of the data signals fca-fcd are compared at the individual receiving locations Pa-Pd, an indicator V for the direction of movement of a mobile data memory MDS can be defined therefrom.

[0022] According to an embodiment of the method according to the invention, the indicator V can be defined through a comparison of changes in the received field strengths of the data signals at the receiving locations Pa-Pd. As a result, the antenna signal fcd of the antenna d1 closest to the mobile data memory MDS has the greatest amplitude, whereas the antenna signal fca of the antenna a1, furthest away from the mobile data memory, has the smallest amplitude. The amplitudes of the antenna signals fcb and fcc of the intermediate antennas b1 and c1 have corresponding intermediate values. If the mobile data memory MDS moves along the movement path 2 in direction V1, the amplitude of the antenna signal fcc of the antenna c1 is maximized after a specific time, etc. These changes can be evaluated in such a way that an indicator for the direction of movement of the mobile data memory MDS is derived.

[0023] As shown in Figure 1, the intermediate-frequency antenna signals fza-fzd are fed for this purpose to an evaluation unit 31, which provides the indicator V for the direction of movement through comparison of the temporal sequence of the amplitude values of the antenna signals from the individual receiving locations. If, in a different case (not shown), the movement of the mobile data memory were not parallel with but at a specific angle to the line of the antennas a1-d1, the indicator V would indicate the tangential component of the direction of movement.

[0024] According to a further embodiment of the method according to the present invention, the indicator V can also be defined through evaluation of the temporal sequence of the logical content of the data signals at the receiving locations Pa-Pd. To do this, the received data signals fca-fcd are decoded and their logical content compared. It is particularly advantageous in this embodiment if the radiation diagrams of the antennas

a1-d1 are aligned and focused as accurately as possible along the movement path 2 of the mobile data memory MDS; and if necessary, the radiation diagrams of the antennas a1-d1 additionally have an overlap in relation to one another which is limited as far as possible. In the example shown in Figure 1, the bubble-shaped field lines Ca-Cd overlap one another only slightly.

[0025] The consequence of the application of this embodiment to the example shown in Figure 1 is that, due to the position of the mobile data memory MSD, decodable data signals can be detected if necessary only by the antennas d1 and c1. Decoding can be carried out in turn in the evaluation unit 31. If the data memory MSD moves in direction V1, decodable data signals can be detected, e.g., by the antennas c1 and b1. These changes in detectability can be evaluated by the evaluation unit 31 to form the indicator V for the direction of movement.

[0026] If, for example, in addition to the mobile data memory MSD, a second data memory MSDx were to move along the movement path 2 under certain circumstances in the opposite direction V2, i.e. in the page plane of Figure 1 from bottom to top, other antennas, e.g., antennas a1 and b1, could receive its data signal, whereas the antennas d1 and c1 would receive the data signal of the data memory MSD. The evaluation unit 31 can distinguish between these data signals following decoding and allocate them to the corresponding mobile data memories MDS or MDSx on the basis of their logical content. It is thus possible to detect simultaneously the directions of movement of a plurality of data memories, for example, as shown in Figure 1 the direction V1 of the data memory MDS, and the opposite direction V2 of the data memory MDSx.

[0027] The receiver 3 can also be designed as a transceiver device for two-way exchange of data signals with mobile data memories. In such a case, the receiver device shown in Figure 1 forms part of the entire device and each channel 3a-3d would additionally contain transmitters to transmit data signals. For the sake of simplicity these are not shown.

[0028] A further embodiment of the invention is described below with reference to Figures 2a and 2b. Here, weighting factors ga-gd are additionally derived, preferably in the evaluation unit 31, from the received field strengths Ca-Cd of the data signals fca-fcd at the receiving locations Pa-Pd in such a way that a higher or lower weighting factor is allocated to a data signal with a strong or weak received field strength. As explained above, strong received signals are thereby further amplified, whereas weak received signals are further attenuated. In Figure 2a, weighting units a3-d3 are additionally provided for this purpose in each channel 3a-3d, whereby the intermediate-frequency antenna signals fza-fzd are converted, by applying the weighting factors ga-gd, into weighted data signals fga-fagd. The latter are in turn fed to the processing unit 32, which synthesizes the processed summation data signal fs. This has a particularly high signal-to-noise ratio and can therefore be decoded in a particularly error-free manner in the demodulator 33.

[0029] The equal-sized, bubble-shaped field lines Ca-Cd from Figure 1 are represented in the detection area 1 in Figure 2a by broken lines, and the field lines Cga-Cgd which are produced as a result of weighting, are represented by continuous lines. Since the reception of data signals of the mobile data memory MDS increasingly deteriorates from the antenna d1 to the antenna a1 due to the distance relationships, the antenna signal of

the antenna d1 is evaluated as particularly strong and the antenna signal of the antenna a1 is evaluated as particularly weak. This causes an apparent swelling or shrinking of the field lines Cga-Cgd compared with the original conditions Ca-Cd. The weighting thus causes an apparent change in the reception ranges of the antennas a1-d1. If the mobile data memory MDS moves within the detection area, the individual reception characteristics of the antennas apparently change as a result of the re-adjustment (effected by the weighting) of the amplitudes of the individual data signals fga-fgd. The resulting reception characteristic of all antennas thus appears to follow the mobile data memory MDS in its movement along the movement path 2. As explained above, an arrangement of this type can also be referred to as an "adaptive antenna."

[0030] Figure 2b shows the condition of the weighting which is set when the mobile data memory MDS moves. Here the data memory is located in a position opposite the receiving locations Pb-Pc and therefore opposite the antennas b1, c1. The data signals fgb, fgc are amplification-weighted, whereas the data signals fga, fgd are attenuation-weighted. This results in the apparent swelling or shrinking of the reception characteristics Cgb, Cgc and Cga, Cgd shown in Figure 2b.

[0031] Figure 2a, the weighted data signals fgd-fga thus contribute with decreasing weighting to the formation of the processed summation data signal fs. In Figure 2b, the weighted data signals fgb, fgc contribute accordingly with a higher weighting and the weighted data signals fga, fgd with a lower weighting to the formation of the processed summation data signal fs. The indicator for the direction of movement can also be advantageously defined through evaluation of the data signals weighted with the

weighting factors, i.e., adapted. The selectivity of the detection of the direction of movement can also be improved thereby.

ABSTRACT OF THE DISCLOSURE

In at least two different receiving locations (Pa-Pd) along the movement path (2) of a mobile data memory (MDS), data signals (fca-fcd) of the data memory are detected, the changes in the data signals relative to the receiving locations are compared, and an indicator (V) for the direction of movement is defined therefrom. The indicator is advantageously defined through comparison of the received field strengths or the temporal sequence of the logical content or the type of the data signals at the receiving locations.

BAKER BOTTS L.L.P.

30 ROCKEFELLER PLAZA

NEW YORK, NEW YORK 10112

TO ALL WHOM IT MAY CONCERN:

Be it known that WE, WOLFGANG PUSCH, MARTIN SCHIEFER, and PETER-ERNST VEITH, all citizens of Austria, whose post office addresses are Getreidemarkt 13/35, A-1060 Wien, Austria; Birkengasse 33, a-3100 St. Pölten, Austria; and Peter-Jordan-Str. 88/6, A-1190, Wien, Austria; respectively, have invented an improvement in:

METHOD AND DEVICE FOR DETECTING THE DIRECTION OF MOVEMENT OF A MOBILE DATA MEMORY, PARTICULARLY IN AN IDENTIFICATION SYSTEM

of which the following is a

SPECIFICATION

FIELD OF THE INVENTION

[0001] The invention relates to a method and device by which the direction of movement of a mobile data memory can be detected in a contactless and simplified manner in an identification system.

BACKGROUND OF THE INVENTION

[0002] ~~[0001]~~ In stationary production and conveyance systems, a multiplicity of objects or goods must normally be moved as quickly and freely as possible with the aid of technical conveyance devices, e.g., conveyor belts. The objects may be of varying types,

comparison

thereon, to control operating means of the relevant technical system. The data can also be updated and then sent back to the mobile data memories in the form of data signals.

[0004] ~~[0003]~~ In technical systems, individual goods may have different directions of movement in the flow of goods. In practice, goods may, under certain circumstances, be moved by one or more conveyance devices in one direction or in the opposite direction. Thus, goods may, at a specific location~~,~~ (e.g.~~,~~ at a gate), move into a production device, or~~, for example,~~ leave this device at the same location after processing. If the direction of movement of individual goods can be detected at such locations, further parts of the production device can be controlled with this information.

[0005] ~~[0004]~~ The direction of movement of goods has hitherto normally been determined in technical systems with the aid of light barriers, switching means and the like. This~~, on the one hand,~~ is expensive~~,~~ since~~, for example,~~ on conveyance means~~,~~ additional~~, normally~~ electromechanical~~,~~ components need to be attached~~,~~ which serve exclusively to detect the direction of movement. ~~However, a~~A further ~~perceived~~ disadvantage is that it is ~~thus~~ possible only to detect the direction of movement of ~~flows~~a flow of goods which are ~~as~~generally similar ~~as possible~~. ~~In such arrangements, a~~A particular problem occurs if the direction of movement of individual goods is to be detected~~. In~~ since in conventional systems~~,~~ it is not immediately possible to detect simultaneously ~~at least~~ the type and~~, under certain circumstances, the~~ current condition of individual goods and their direction of movement, and to relate them to one another.

comparison

~~[0005] The object of the invention is to indicate a method and a device with which the direction of movement of mobile data memories can be detected in a contactless manner and, as far as possible, without additional outlay in terms of technical components.~~

~~[0006] This object is achieved with the method and devices indicated in the claims. Advantageous further designs of the invention are contained in the further subclaims.~~

SUMMARY OF THE INVENTION

[0006] ~~[0007]~~ The object of the present invention is to provide~~The object of the invention is to indicate~~ a method and a device with which the direction of movement of mobile data memories can be detected in a contactless manner and, as far as possible, ~~without~~without an additional outlay in terms of technical components. In the method according to the present invention, in at least two different receiving locations along ~~the~~a movement path of a mobile data memory, data signals of said memory and changes in these data signals are detected ~~at or relative to the receiving locations~~. An indicator for the direction of movement of the mobile data memory can be defined from a comparison of these parameters.

[0007] ~~[0008]~~ ~~The~~An advantage of the method according to the present invention is that the direction of movement is detected exclusively using data signals which the mobile data memories transmit for the purpose of communicating with a receiver or transceiver device. ~~This is particularly advantageous, since~~Thus the data signals can ~~thus~~ be used in a dual manner, i.e., ~~on the one hand,~~ as a carrier for data, and~~, on the other hand,~~ as a medium for identification of a direction of movement. If data signals of this type are received in at least two receiving locations positioned along the movement path of the

comparison

data memories, the direction of movement of the data memories can be detected from ~~the~~a comparison of changes in these data signals. No additional separate components, e.g., light barriers and the like, are thus required. ~~Rather~~Instead, the direction of movement can be detected in addition to the data exchange between mobile data memories and a receiver or transceiver device in a contactless, all-electronic manner.

[0008] ~~[0009]~~ In ~~a first design~~one preferred embodiment of the method according to the present invention, the indicator for the direction of movement is defined through a comparison of changes in the received field strengths of a data signal at the receiving locations. The data content of the data signal is irrelevant ~~here~~. ~~Rather~~Instead, ~~through~~by ~~comparisons~~comparing, ~~particularly~~for ~~of~~example, the increases and decreases in the received field strengths of the data signal in at least two receiving locations, it is possible to detect whether the mobile data memory which transmits this data signal is moving away from or toward a receiving location. Following evaluation of the received field strengths, the data signal can be decoded in a conventional manner and the data content can be further processed.

[0009] ~~[0010]~~ In ~~a further design~~another preferred embodiment of the method according to the present invention, weighting factors are derived through a comparison of the received field strengths of the data signals at the receiving locations in such a way that a high or low weighting factor is allocated to a data signal which has a strong or weak received field strength. The result ~~of this~~ is that data signals from those receiving locations which are close to the mobile data memory and thus have high reception quality are further amplified, whereas the data signals from receiving locations which are further

comparison

away from the mobile data memory and thus have lower reception quality are further attenuated. The signal-to-noise ratio, and therefore reception quality are thus improved.

[0010] ~~[0011]~~ The adaptation of the data signals by means of weighting can be exploited in two ways. ~~On the one hand~~First, in a downstream evaluation unit, using all instantaneously available data signals from the individual receiving locations and taking into account their weighting, an optimum summation data signal can be synthesized which has the highest possible signal-to-noise ratio and can thus be decoded as far as possible without errors. ~~On the other hand~~Second, the indicator for the direction of movement can also be advantageously defined through evaluation of the data signals and weighted with the weighting factors, i.e., adapted. ~~The~~Thus, the selectivity of the direction of movement detection can thereby be improved.

[0011] ~~[0012]~~ In a further ~~design~~preferred embodiment of the method according to the present invention, the indicator for the direction of movement can be defined through a comparison of the type of data signals. ~~Here~~Accordingly, a receiver or transceiver device can~~, in particular,~~ evaluate whether the data signals received at the receiving locations are external signals or user data signals. By tracking the reception of a data signal at the individual receiving locations, its type having been identified in particular as a user data signal, it is similarly possible to detect whether an associated mobile data memory is moving away from or toward a receiving location. In this case ~~also,~~ a data signal, ~~following~~after its evaluation ~~of its type~~ for the purpose of identification of the direction of movement, can be decoded in a conventional manner and its data content can be further processed.

comparison

[0012] ~~[0013]~~ In ~~a further design of~~another preferred embodiment the method according to the present invention, data signals which are received at different receiving locations are not evaluated for the purpose of identification of the direction of movement until they have been decoded and their logical content defined. This ~~design~~embodiment offers the ~~particular~~ advantage that no different conditions of the data signals need to be used to detect the direction of movement and to process the logical content of the data signals. ~~Rather~~Instead, the data signals received at the receiving locations are decoded in a conventional manner and are then available for further processing, ~~in particular~~e.g., in a binary data processing unit. As one of these processing steps, the indicator for the direction of movement can then be defined in the data processing unit through evaluation, in particular, of the temporal sequence in which individual data signals have been received at the receiving location and through comparison of their content. If, for example, a data signal, which can be allocated following decoding to a specific mobile data memory, is successively received at different receiving locations, it is possible to detect from the temporal sequence of this reception whether the mobile data memory which transmits this data signal is moving away from or toward a receiving location.

[0013] ~~[0014]~~ ~~This design~~The aforesaid embodiment of the method according to the present invention offers the further advantage that the logical content of data signals can be uniquely allocated to individual mobile data memories following decoding. As a result, it is ~~then~~ possible to detect the direction of movement of a plurality of mobile data memories which successively or virtually simultaneously pass the receiving locations along the movement path.

comparison

[0014] ~~[0015] Finally~~Furthermore, an indicator for the direction of movement can also be defined by simultaneously using a plurality of the above-described methods ~~described above~~. The data signals can thus advantageously be evaluated simultaneously taking into account not only their field strength but also their logical data content which is available following decoding.

[0015] ~~[0016] An~~A ~~advantageous~~preferred device ~~to~~for ~~carry~~carrying out the method according to the present invention ~~contains~~comprises an adaptive receiver ~~device. This~~which has at least two antennas which are disposed along the movement path of a mobile data memory and enable at least the reception of data signals. The antennas are connected to an evaluation unit which defines an indicator for the direction of movement of a mobile data memory from the received data signals. A transceiver device, which contains the adaptive receiver device as a component, is advantageously provided for two-way exchange of data signals with mobile data memories.

[0016] ~~[0017]~~ The method according to the invention and the device suitable for carrying it out can be used particularly advantageously in an identification system which has at least mobile data memories fitted to mobile goods, and in which data characterizing the relevant goods are stored in a mobile data memory.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] ~~[0018]~~ The present invention ~~and further advantageous areas of the same are~~is described in greater detail ~~with reference to the block diagrams shown in the figures briefly described~~ below in connection with the following drawings, in which:

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Figure 1: ~~shows the block diagram of~~ illustrates a first ~~typical~~ device, which is particularly ~~advantageously~~ suited to carrying out the method according to the invention, and in which a mobile data memory~~, by way of example,~~ enters the detection area~~,~~;

Figure 2a: ~~shows the block diagram of a further~~ illustrates another device suited to carrying out the method according to the invention~~, in which, to~~ supplement to the design shown in ~~figure 1,~~Figure 1 in which adaptation of the data signals received at different receiving locations is additionally carried out, and in which a mobile data memory, by way of example, similarly enters the detection area~~,~~; and

Figure 2b: ~~shows a block diagram largely corresponding~~ generally corresponds to ~~figure~~Figure 2a~~, in which~~, however, ~~in contrast to the condition of figure~~unlike Figure 2a, the mobile data memory has ~~already~~ partially passed through the detection area.

DETAILED DESCRIPTION OF THE INVENTION

[0018] ~~[0019]~~ The block diagram in ~~figure~~Figure 1 shows, on the left-hand side, a typical mobile data memory MDS, which moves along a movement path 2 in a first direction V1, i.e. on the page plane from top to bottom. The radiation area of the data signals transmitted by the mobile data memory MDS is represented in ~~the example in figure~~Figure 1 by a curved field line Smds. The received field strength of the data signals is intended to have a matching value along this field line. Corresponding field lines could be drawn in the form of rings inside or outside the field line Smds. These field lines would then represent higher or lower received field strength values. However, additional

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field lines of this type are not shown in the ~~figures~~Figure for the sake of ~~greater clarity~~simplicity.

[0019] ~~[0020]~~ Figure 1 furthermore shows, on the right-hand side, a receiver device ~~3. The~~3 ~~latter~~which contains~~, by way of example,~~ four parallel channels 3a~~...~~3d. Each channel contains an antenna a1~~...~~d1, which is disposed at a receiving location Pa~~...~~Pd along the movement path 2. The reception ranges of the antennas a1~~...~~d1 are similarly represented in ~~figure~~Figure 1 by bubble-shaped field lines Ca~~...~~Cd. The sum of these "reception lobes" Ca~~...~~Cd forms the detection area of the device 3. The arrangement shown in ~~figure~~Figure 1 can also be referred to as an "adaptive antenna." Here, a specific number of equivalent antennas disposed along a movement path are~~, as it were,~~ interconnected in one line. Their "reception lobes" Ca~~...~~Cd are ~~advantageously~~ aligned and focused as accurately as possible and have a minimal overlap in relation to one another.

[0020] ~~[0021]~~ The antennas a1~~...~~d1 receive the data signals transmitted by the mobile data memory MDS in the form of radio-frequency antenna signals fca~~...~~fzd. These signals are in each case fed to a receiver a2~~...~~d2, which forms intermediate-frequency antenna signals fza~~...~~fzd therefrom. These signals are fed to a processing unit 32, which synthesizes a processed summation data signal fs ~~therefrom~~. This signal is finally decrypted in a demodulator 33 and is then available as a decoded, preferably digital, data stream fd for further processing. ~~Preferably digital~~Digital computing units suitable for this purpose are not shown further in the ~~figures~~Figure for the sake of ~~clarity~~simplicity.

comparison

[0021] ~~[0022]~~ In ~~the example shown in figure~~Figure 1, the data signals of the mobile data memory MDS are detected in the form of the four antenna signals fza~~,...,~~fzd. The reception differs at the four receiving locations Pa~~,...,~~Pd due to the relative position of the mobile data memory MDS in relation to the individual antennas a1~~,...,~~d1. The reception is subject to changes due to the movement of the mobile data memory MDS along the movement path 2. If these changes in the reception of the data signals fca~~,...,~~fcd are compared at the individual receiving locations Pa~~,...,~~Pd, an indicator V for the direction of movement of a mobile data memory MDS can be defined therefrom.

[0022] ~~[0023]~~ According to ~~a first design~~an embodiment of the method according to the invention, the indicator V ~~for the direction of movement~~ can be defined through a comparison of changes in the received field strengths of the data signals at the receiving locations Pa~~,...,~~Pd. As a result, ~~in the example shown in figure 1,~~ the antenna signal fcd of the antenna d1 closest to the mobile data memory MDS has the greatest amplitude, whereas the antenna signal fca of the antenna a~~1~~1, furthest away from the mobile data memory, has the smallest amplitude. The amplitudes of the antenna signals fcb and fcc of the intermediate antennas b1 and c1 have corresponding intermediate values. If the mobile data memory MDS ~~then~~ moves along the movement path 2 in direction V1, the amplitude of the antenna signal fcc of the antenna c1 is maximized after a specific time, etc. These changes can be evaluated in such a way that an indicator for the direction of movement of the mobile data memory MDS is derived.

[0023] ~~[0024] In the example~~As shown in ~~figure~~Figure 1, the intermediate-frequency antenna signals fza~~,...,~~fzd are fed for this purpose to an evaluation unit 31, which

comparison

provides the indicator V for the direction of movement through comparison of the temporal sequence of the amplitude values of the antenna signals from the individual receiving locations. If, in a different case (not shown), the movement of the mobile data memory were not parallel with but at a specific angle to the line of the antennas a1-...-d1, the indicator V would indicate the tangential component of the direction of movement.

[0024] ~~[0025]~~ According to a further ~~design~~embodiment of the method according to the present invention ~~already explained above~~, the indicator V ~~for the direction of movement~~ can also be defined through evaluation of the temporal sequence of the logical content of the data signals at the receiving locations Pa-...-Pd. To do this, the received data signals fca-...-fcd are decoded and their logical content compared. It is particularly advantageous ~~for~~in this ~~design~~embodiment if the radiation diagrams of the antennas a1-...-d1 are aligned and focused as accurately as possible along the movement path 2 of the mobile data memory MDS, and, if necessary, the radiation diagrams of the antennas a1-...-d1 additionally have an overlap in relation to one another which is limited as far as possible. In the example shown in ~~figure~~Figure 1, the bubble-shaped field lines Ca-...-Cd overlap one another only slightly.

[0025] ~~[0026]~~ The consequence of the application of this ~~design~~embodiment to the example shown in ~~figure~~Figure 1 is that, due to the position of the mobile data memory MSD, decodable data signals can be detected if necessary only by the antennas d1 and c1. Decoding can be carried out in turn in the evaluation unit 31. If the data memory MSD moves in direction V1, decodable data signals can be detected, e.g., by the antennas c1

comparison

and b1. These changes in detectability can be evaluated by the evaluation unit 31 to form the indicator V for the direction of movement.

[0026] ~~[0027]~~ If, for example, in addition to the mobile data memory MSD, a second data memory MSDx were to move along the movement path 2 under certain circumstances in the opposite direction V2, i.e. in the page plane of ~~figure~~Figure 1 from bottom to top, other antennas, ~~in the example the~~e.g., antennas a1 and b1, could receive its data signal, whereas the antennas d1 and c1 would receive the data signal of the data memory MSD. The evaluation unit 31 can distinguish between these data signals following decoding and allocate them to the corresponding mobile data memories MDS or MDSx on the basis of their logical content. It is thus possible to detect simultaneously the directions of movement of a plurality of data memories, ~~in the~~for example, as shown in ~~figure~~Figure 1 the direction V1 of the data memory MDS, and the opposite direction V2 of the data memory MDSx.

[0027] ~~[0028]~~ The ~~device~~receiver 3 can also be designed as a transceiver device for two-way exchange of data signals with mobile data memories. In such a case, the receiver device shown in ~~figure~~Figure 1 forms part of the entire device and each channel 3a~~...~~3d would additionally contain transmitters to transmit data signals. For the sake of ~~clarity~~simplicity these are not shown ~~in the figures~~.

[0028] ~~[0029]~~ A further ~~design~~embodiment of the invention is ~~explained~~described below with reference to ~~figures~~Figures 2a and 2b. Here, weighting factors ga~~...~~gd are additionally derived, preferably in the evaluation unit 31, from the received field strengths Ca~~...~~Cd of the data signals fca~~...~~fcd at the receiving locations Pa~~...~~Pd in

comparison

such a way that a higher or lower weighting factor is allocated to a data signal with a strong or weak received field strength. As ~~already~~ explained above, strong received signals are thereby further amplified, whereas weak received signals are further attenuated. In ~~the example shown in figure 2,~~Figure 2a, weighting units a3~~...~~-d3 are additionally provided for this purpose in each channel 3a~~...~~-3d, whereby the intermediate-frequency antenna signals fza~~...~~-fzd are converted, by applying the weighting factors ga~~...~~-gd, into weighted data signals fga~~...~~-fagd. The latter are in turn fed to the processing unit 32, which synthesizes the processed summation data signal fs ~~therefrom~~. This has a particularly high signal-to-noise ratio and can therefore be decoded in a particularly error-free manner in the demodulator 33.

[0029] ~~**[0030]** To explain this situation, on the one hand, the~~The equal-sized, bubble-shaped field lines Ca~~...~~-Cd from ~~figure~~Figure 1 are represented in the detection area 1 in ~~figure~~Figure 2a by broken lines, and~~, on the other hand,~~ the field lines Cga~~...~~-Cgd~~,~~ which are produced as a result of weighting, are represented by continuous lines. Since the reception of data signals of the mobile data memory MDS increasingly deteriorates from the antenna d1 to the antenna a1 due to the distance relationships, the antenna signal of the antenna d~~1, for example,~~1 is evaluated as particularly strong and the antenna signal of the antenna a1 is evaluated as particularly weak. This causes an apparent swelling or shrinking of the field lines Cga~~...~~-Cgd compared with the original conditions Ca~~...~~-Cd. The weighting thus causes an apparent change in the reception ranges of the antennas a1~~...~~-d1. If the mobile data memory MDS moves within the detection area, the individual reception characteristics of the antennas apparently change as a result of the re-adjustment~~,~~ (effected by the weighting~~,~~) of the amplitudes of the individual data

comparison

signals fga~~,...,~~fgd. The resulting reception characteristic of all antennas thus appears to follow the mobile data memory MDS in its movement along the movement path 2. As ~~already~~ explained above, an arrangement of this type can also be referred to as an "adaptive antenna."

[0030] ~~**[0031]**~~ Figure 2b shows~~, by way of example,~~ the condition of the weighting which is set when the mobile data memory MDS moves. Here~~,~~ the data memory is located in a position opposite the receiving locations Pb~~,...,~~Pc and therefore opposite the antennas b1, c1. The data signals fgb, fgc are amplification-weighted, whereas the data signals fga, fgd are attenuation-weighted. This results in the apparent swelling or shrinking of the reception characteristics Cgb, Cgc and Cga, Cgd shown in ~~figure~~Figure 2b.

[0031] ~~**[0032]** In the example shown in figure~~Figure 2a, the weighted data signals fgd~~,...,~~fga thus contribute with decreasing weighting to the formation of the processed summation data signal fs. In ~~the example shown in figure~~Figure 2b, the weighted data signals fgb, fgc contribute accordingly with a higher weighting and the weighted data signals fga, fgd with a lower weighting to the formation of the processed summation data signal fs. ~~On the other hand, the~~The indicator for the direction of movement can also be advantageously defined through evaluation of the data signals weighted with the weighting factors, i.e.~~,~~ adapted. The selectivity of the detection of the direction of movement can also be improved thereby.

comparison

WE CLAIM:

~~1. A method for detecting the direction of movement of a mobile data memory (MDS) along a movement path (2), characterized in that~~

1. ~~(a)~~ A method for detecting the direction of movement of a mobile data memory ~~(MDS) along a movement path (2), characterized in that~~along a movement path, comprising detecting data signals ~~(fca…fcd)~~ of a mobile data memory ~~(MDS) are detected~~ in at least two different receiving locations ~~(Pa…Pd)~~ along the movement path ~~(2)~~, comparing changes in the data signals ~~(fca…fcd) are compared~~ at the receiving locations ~~(Pa…Pd), and therefrom~~, and defining therefrom an indicator ~~an indicator (V) is defined~~ for the direction of movement of a mobile data memory ~~(MDS).~~.

~~(b) changes in the data signals (fca…fcd) are compared at the receiving locations (Pa…Pd), and therefrom~~

~~(c) an indicator (V) is defined for the direction of movement of a mobile data memory (MDS).~~

2. The method ~~as claimed in~~according to claim 1, ~~characterized in that~~wherein the indicator ~~(V) for the direction of movement~~ is defined ~~through~~by comparison of changes in ~~the~~ received field strengths ~~(Ca…Cd)~~ of data signals ~~(fca…fcd)~~ at the receiving locations ~~(Pa…Pd)~~.

~~3. The method as claimed in claim 1 or 2, characterized in that through~~

~~(a) comparison of the received field strengths (Ca…Cd) of the data signals (fca…fcd) at the receiving locations (Pa…Pd), weighting factors (ga…gd) are derived in such a way that~~

comparison

3. ~~(b)~~ The method according to claim 2, wherein weighting factors are derived by comparison of the received field strengths ~~(Ca...Cd) of the data signals (fca...fcd)~~ of the data signals at the receiving locations ~~(Pa...Pd), weighting factors (ga...gd) are derived in such a way that~~in such a way that a higher or lower weighting factor ~~(ga...gd)~~ is allocated ~~(fga...fgd)~~ to a data signal ~~(fca...fcd)~~ with a stronger or weaker received field strength ~~(Ca...Cd)~~.

4. The method ~~as claimed in~~according to claim 3, ~~characterized in that~~wherein the indicator ~~(V) for the direction of movement~~ is defined ~~through~~by evaluation of the data signals ~~(fga...fgd)~~ weighted with the weighting factors ~~(ga...gd)~~.

5. The method ~~as claimed in one of the preceding claims, characterized in that~~according to claim 1, further comprising defining the indicator ~~(V) for the direction of movement is defined through~~by comparison of the data signals' type ~~of data signals (fca...fcd)~~ at the receiving locations ~~(Pa...Pd)~~.

6. The method ~~as claimed in one of the preceding claims, characterized in that~~according to claim 1, further comprising decoding the received data signals ~~(fca...fcd) are decoded~~, and defining their logical content ~~defined~~.

7. The method ~~as claimed in~~according to claim 6, ~~characterized in that~~wherein the indicator ~~(V) for the direction of movement~~ is defined ~~through~~by evaluation of ~~the~~a temporal sequence of the logical content of the data signals at the receiving locations ~~(Pa...Pd)~~.

comparison

8. The method ~~as claimed in~~according to claim ~~6 or 7, characterized in that~~6, wherein the logical content of the data signals ~~(fca…fcd)~~ is allocated to mobile data memories ~~(MDS)~~.

~~9. A device to carry out the method as claimed in one of the preceding claims, characterized by an adaptive receiver device (3) with~~

~~(a) at least two antennas (a1…d1) at least for the reception of data signals (fza…fzd), which are disposed along the movement path (2) of a mobile data memory (MDS), and with~~

9. ~~(b)~~ A device for carrying out the method according to claim 1, comprising an adaptive receiver having at least two antennas~~at least two antennas (a1…d1) at least~~ for the reception of data signals ~~(fza…fzd),~~ which are disposed along ~~the movement path (2) of a mobile data memory (MDS), and with~~a movement path of a mobile data memory, and an evaluation unit ~~(31),~~ which is connected to the antennas ~~(a1…d1)~~ and which defines an indicator ~~(V)~~ for the direction of movement of a mobile data memory ~~(MDS)~~ from the data signals ~~(fza…fzd)~~.

10. The device ~~as claimed in~~according to claim 9, ~~characterized~~further ~~by~~comprising a transceiver ~~device~~ for two--way exchange of data signals with mobile data memories ~~(MDS),~~and which contains the adaptive receiver device ~~(3)~~.

11. The device ~~as claimed in~~according to claim ~~9 or 10, characterized by~~9, wherein the antennas ~~(a1…d1)~~have ~~whose~~antenna radiation diagrams which are aligned and focused ~~as accurately as possible~~ along the movement path ~~(2)~~ of mobile data memories ~~(MDS)~~.

comparison

12. The device ~~as claimed in~~according to claim 11, ~~characterized in~~ ~~that~~wherein the radiation diagrams ~~of the antennas (a1...d1)~~ have an overlap in relation to one another which is as limited as possible.

13. The use of ~~a~~the method ~~as claimed in one of claims~~according to claim 1 ~~to~~ ~~8~~ in an identification system ~~which at least has~~having a mobile data ~~memories~~ ~~(MDS)~~memory attached to mobile goods, whereby data characterizing the respective goods are stored in ~~a~~the mobile data memory ~~(MDS)~~.

14. The ~~use of a~~ device ~~as claimed in one of claims~~according to claim 9 ~~to~~for ~~12~~use in an identification system ~~which at least has~~having a mobile data ~~memories~~ ~~(MDS)~~memory attached to mobile goods, whereby data characterizing the respective goods are stored in ~~a~~the mobile data memory ~~(MDS)~~.

comparison

ABSTRACT OF THE DISCLOSURE

In at least two different receiving locations (Pa...Pd) along the movement path (2) of a mobile data memory (MDS), data signals (fca...fcd) of the data memory are detected, the changes in the data signals relative to the receiving locations are compared, and an indicator (V) for the direction of movement is defined therefrom. The indicator is advantageously defined through comparison of the received field strengths or the temporal sequence of the logical content or the type of the data signals at the receiving locations.

comparison

Description

Method and device for detecting the direction of movement of a mobile data memory, particularly in an identification system

In stationary production and conveyance systems, a multiplicity of objects or goods must normally be moved as quickly and freely as possible with the aid of technical conveyance devices, e.g. conveyor belts. The objects may be of varying types, e.g. packages in a dispatch device, assembly parts in a production system, items of luggage in a conveyance system and many more. Here, it is normally necessary to detect quickly and unhindered, at specific locations in the system, e.g. the type and condition of the objects currently in the physical vicinity of these locations. To do this, the objects are, on the one hand, provided with mobile data memories which, for example, contain data characterizing the type and current condition of the objects. On the other hand, stationary communications devices are placed at specific locations in the system and are usually connected to a central data processing device. The communications devices enable at least contactless reception of data signals which are transmitted by the mobile data memories via a usually radio-based data transmission path. Depending on the system type, the communications devices may be purely receiver devices or transceiver devices which enable two-way exchange of data signals with the mobile data memories.

A system for contactless detection of data signals of the type described above is also referred to as an identification system. If, for example, in a production

process, objects provided with mobile data memories are moved into the vicinity of a selected location, a

receiver or transceiver device located there can detect, in a contactless manner, data

signals from the mobile data memories of those objects which are currently located within its detection area. The data contained in these data signals can be decoded with the aid of a higher-order central data processing device and evaluated for different purposes, e.g. to track the movement of the objects provided with the mobile data memories and, for example, depending thereon, to control operating means of the relevant technical system. The data can also be updated and then sent back to the mobile data memories in the form of data signals.

In technical systems, individual goods may have different directions of movement in the flow of goods. In practice, goods may, under certain circumstances, be moved by one or more conveyance devices in one direction or in the opposite direction. Thus, goods may, at a specific location, e.g. at a gate, move into a production device, or, for example, leave this device at the same location after processing. If the direction of movement of individual goods can be detected at such locations, further parts of the production device can be controlled with this information.

The direction of movement of goods has hitherto normally been determined in technical systems with the aid of light barriers, switching means and the like. This, on the one hand, is expensive, since, for example, on conveyance means, additional, normally electromechanical, components need to be attached, which serve exclusively to detect the direction of movement. However, a further perceived disadvantage is that it is thus possible only to detect the direction of movement of flows of goods which are as similar as possible. In such arrangements, a particular problem occurs if the direction of movement of individual goods is to be detected. In conventional

the type and, under certain circumstances, the current condition of individual goods and

their direction of movement and to relate them to one another.

The object of the invention is to indicate a method and a device with which the direction of movement of mobile data memories can be detected in a contactless manner and, as far as possible, without additional outlay in terms of technical components.

This object is achieved with the method and devices indicated in the claims. Advantageous further designs of the invention are contained in the further subclaims.

In the method according to the invention, in at least two different receiving locations along the movement path of a mobile data memory, data signals of said memory and changes in these data signals are detected at or relative to the receiving locations. An indicator for the direction of movement of the mobile data memory can be defined from a comparison of these parameters.

The advantage of the method according to the invention is that the direction of movement is detected exclusively using data signals which the mobile data memories transmit for the purpose of communicating with a receiver or transceiver device. This is particularly advantageous, since the data signals can thus be used in a dual manner, i.e., on the one hand, as a carrier for data and, on the other hand, as a medium for identification of a direction of movement. If data signals of this type are received in at least two receiving locations positioned along the movement path of the data memories, the direction of movement of the data memories can be detected from the comparison of changes in these data signals. No

systems, it is not immediately possible to detect simultaneously at least

required. Rather, the direction of movement can be detected in addition to the data

additional separate components, e.g. light barriers and the like, are thus

exchange between mobile data memories and a receiver or transceiver device in a contactless, all-electronic manner.

In a first design of the method according to the invention, the indicator for the direction of movement is defined through a comparison of changes in the received field strengths of a data signal at the receiving locations. The data content of the data signal is irrelevant here. Rather, through comparisons, particularly of the increases and decreases in the received field strengths of the data signal in at least two receiving locations, it is possible to detect whether the mobile data memory which transmits this data signal is moving away from or toward a receiving location. Following evaluation of the received field strengths, the data signal can be decoded in a conventional manner and the data content can be further processed.

In a further design of the method according to the invention, weighting factors are derived through a comparison of the received field strengths of the data signals at the receiving locations in such a way that a high or low weighting factor is allocated to a data signal which has a strong or weak received field strength. The result of this is that data signals from those receiving locations which are close to the mobile data memory and thus have high reception quality are further amplified, whereas the data signals from receiving locations which are further away from the mobile data memory and thus have lower reception quality are further attenuated. The signal-to-noise ratio and therefore reception quality are thus improved.

The adaptation of the data signals by means of weighting can be exploited in two ways. On the one

hand, in a downstream evaluation unit, using all instantaneously available data signals from the individual receiving locations and taking

into account their weighting, an optimum summation data signal can be synthesized which has the highest possible signal-to-noise ratio and can thus be decoded as far as possible without errors. On the other hand, the indicator for the direction of movement can also be advantageously defined through evaluation of the data signals and weighted with the weighting factors, i.e. adapted. The selectivity of the direction of movement detection can thereby be improved.

In a further design of the method according to the invention, the indicator for the direction of movement can be defined through a comparison of the type of data signals. Here, a receiver or transceiver device can, in particular, evaluate whether the data signals received at the receiving locations are external signals or user data signals. By tracking the reception of a data signal at the individual receiving locations, its type having been identified in particular as a user data signal, it is similarly possible to detect whether an associated mobile data memory is moving away from or toward a receiving location. In this case also, a data signal, following evaluation of its type for the purpose of identification of the direction of movement, can be decoded in a conventional manner and its data content can be further processed.

In a further design of the method according to the invention, data signals which are received at different receiving locations are not evaluated for the purpose of identification of the direction of movement until they have been decoded and their logical content defined. This design offers the particular advantage that no different conditions of the data signals need to be used to detect the direction of movement and to process the logical

content of the data signals. Rather, the data signals received at the receiving locations are decoded in a conventional manner and are

then available for further processing, in particular in a binary data

processing unit. As one of these processing steps, the indicator for the direction of movement can then be defined in the data processing unit through evaluation, in particular of the temporal sequence in which individual data signals have been received at the receiving location and through comparison of their content. If, for example, a data signal, which can be allocated following decoding to a specific mobile data memory, is successively received at different receiving locations, it is possible to detect from the temporal sequence of this reception whether the mobile data memory which transmits this data signal is moving away from or toward a receiving location.

This design of the method according to the invention offers the further advantage that the logical content of data signals can be uniquely allocated to individual mobile data memories following decoding. As a result, it is then possible to detect the direction of movement of a plurality of mobile data memories which successively or virtually simultaneously pass the receiving locations along the movement path.

Finally, an indicator for the direction of movement can also be defined by simultaneously using a plurality of the methods described above. The data signals can thus advantageously be evaluated simultaneously taking into account not only their field strength but also their logical data content which is available following decoding.

An advantageous device to carry out the method according to the invention contains an adaptive receiver device. This has at least two antennas which are disposed along the movement path of a mobile data memory and enable at

least the reception of data signals. The antennas are connected to an evaluation unit which defines an indicator for the direction of

movement of a mobile data memory from the received data signals. A

transceiver device, which contains the adaptive receiver device as a component, is advantageously provided for two-way exchange of data signals with mobile data memories.

The method according to the invention and the device suitable for carrying it out can be used particularly advantageously in an identification system which has at least mobile data memories fitted to mobile goods, and in which data characterizing the relevant goods are stored in a mobile data memory.

The invention and further advantageous areas of the same are described in detail with reference to the block diagrams shown in the figures briefly described below, in which:

Figure 1: shows the block diagram of a first typical device, which is particularly advantageously suited to carrying out the method according to the invention, and in which a mobile data memory, by way of example, enters the detection area,

Figure 2a: shows the block diagram of a further device suited to carrying out the method according to the invention, in which, to supplement the design shown in figure 1, adaptation of the data signals received at different receiving locations is additionally carried out, and in which a mobile data memory, by way of example, similarly enters the detection area, and

Figure 2b: shows a block diagram largely corresponding to figure 2a, in which, however, in contrast to the condition of figure 2a, the mobile

data memory has already partially passed through the detection area.

The block diagram in figure 1 shows, on the left-hand side, a typical mobile data memory MDS, which moves along a movement path 2 in a first direction V1, i.e. on the page plane from top to bottom. The radiation area of the data signals transmitted by the mobile data memory MDS is represented in the example in figure 1 by a curved field line Smds. The received field strength of the data signals is intended to have a matching value along this field line. Corresponding field lines could be drawn in the form of rings inside or outside the field line Smds. These field lines would then represent higher or lower received field strength values. However, additional field lines of this type are not shown in the figures for the sake of greater clarity.

Figure 1 furthermore shows, on the right-hand side, a receiver device 3. The latter contains, by way of example, four parallel channels 3a...3d. Each channel contains an antenna a1...d1, which is disposed at a receiving location Pa...Pd along the movement path 2. The reception ranges of the antennas a1...d1 are similarly represented in figure 1 by bubble-shaped field lines Ca...Cd. The sum of these "reception lobes" Ca...Cd forms the detection area of the device 3. The arrangement shown in figure 1 can also be referred to as an "adaptive antenna". Here, a specific number of equivalent antennas disposed along a movement path are, as it were, interconnected in one line. Their "reception lobes" Ca...Cd are advantageously aligned and focused as accurately as possible and have a minimal overlap in relation to one another.

The antennas a1...d1 receive the data signals transmitted by the mobile data memory MDS in the form of radio-

frequency antenna signals fca…fzd. These signals are in each case fed to a receiver a2…d2, which forms

intermediate-frequency antenna signals fza…fzd therefrom. These signals are fed to a

processing unit 32, which synthesizes a processed summation data signal fs therefrom. This signal is finally decrypted in a demodulator 33 and is then available as a decoded, preferably digital, data stream fd for further processing. Preferably digital computing units suitable for this purpose are not shown further in the figures for the sake of clarity.

In the example shown in figure 1, the data signals of the mobile data memory MDS are detected in the form of the four antenna signals fza...fzd. The reception differs at the four receiving locations Pa...Pd due to the relative position of the mobile data memory MDS in relation to the individual antennas a1...d1. The reception is subject to changes due to the movement of the mobile data memory MDS along the movement path 2. If these changes in the reception of the data signals fca...fcd are compared at the individual receiving locations Pa...Pd, an indicator V for the direction of movement of a mobile data memory MDS can be defined therefrom.

According to a first design of the method according to the invention, the indicator V for the direction of movement can be defined through a comparison of changes in the received field strengths of the data signals at the receiving locations Pa...Pd. As a result, in the example shown in figure 1, the antenna signal fcd of the antenna d1 closest to the mobile data memory MDS has the greatest amplitude, whereas the antenna signal fca of the antenna a1 furthest away from the mobile data memory has the smallest amplitude. The amplitudes of the antenna signals fcb and fcc of the intermediate antennas b1 and c1 have corresponding intermediate values. If the mobile data memory MDS then moves along the movement path 2 in

direction V1, the amplitude of the antenna signal fcc of the antenna c1 is maximized

after a specific time, etc. These changes can be evaluated in such a way that an indicator for

the direction of movement of the mobile data memory MDS is derived.

In the example shown in figure 1, the intermediate-frequency antenna signals fza...fzd are fed for this purpose to an evaluation unit 31, which provides the indicator V for the direction of movement through comparison of the temporal sequence of the amplitude values of the antenna signals from the individual receiving locations. If, in a different case (not shown), the movement of the mobile data memory were not parallel with but at a specific angle to the line of the antennas a1...d1, the indicator V would indicate the tangential component of the direction of movement.

According to a further design of the method according to the invention already explained above, the indicator V for the direction of movement can also be defined through evaluation of the temporal sequence of the logical content of the data signals at the receiving locations Pa...Pd. To do this, the received data signals fca...fcd are decoded and their logical content compared. It is particularly advantageous for this design if the radiation diagrams of the antennas a1...d1 are aligned and focused as accurately as possible along the movement path 2 of the mobile data memory MDS, and, if necessary, the radiation diagrams of the antennas a1...d1 additionally have an overlap in relation to one another which is limited as far as possible. In the example shown in figure 1, the bubble-shaped field lines Ca...Cd overlap one another only slightly.

The consequence of the application of this design to the example shown in figure 1 is that, due to the position of the mobile data memory MSD, decodable data signals can be

detected if necessary only by the antennas d1 and c1. Decoding can be carried out in turn in the evaluation unit 31. If the data memory MSD moves

in direction V1, decodable data signals can be detected, e.g. by the antennas c1 and b1. These changes in

detectability can be evaluated by the evaluation unit 31 to form the indicator V for the direction of movement.

If, for example, in addition to the mobile data memory MSD, a second data memory MSDx were to move along the movement path 2 under certain circumstances in the opposite direction V2, i.e. in the page plane of figure 1 from bottom to top, other antennas, in the example the antennas a1 and b1, could receive its data signal, whereas the antennas d1 and c1 would receive the data signal of the data memory MSD. The evaluation unit 31 can distinguish between these data signals following decoding and allocate them to the corresponding mobile data memories MDS or MDSx on the basis of their logical content. It is thus possible to detect simultaneously the directions of movement of a plurality of data memories, in the example shown in figure 1 the direction V1 of the data memory MDS and the opposite direction V2 of the data memory MDSx.

The device 3 can also be designed as a transceiver device for two-way exchange of data signals with mobile data memories. In such a case, the receiver device shown in figure 1 forms part of the entire device and each channel 3a...3d would additionally contain transmitters to transmit data signals. For the sake of clarity these are not shown in the figures.

A further design of the invention is explained with reference to figures 2a and 2b. Here, weighting factors ga...gd are additionally derived, preferably in the evaluation unit 31, from the received field strengths Ca...Cd of the data signals fca...fcd at the receiving locations Pa...Pd in such a way that a higher or lower weighting factor is allocated to a data signal with a

strong or weak received field strength. As already explained above, strong received signals are thereby

further amplified, whereas weak received signals are further attenuated. In the example shown in figure 2, weighting units

a3...d3 are additionally provided for this purpose in each channel 3a...3d, whereby the intermediate-frequency antenna signals fza...fzd are converted, by applying the weighting factors ga...gd, into weighted data signals fga...fagd. The latter are in turn fed to the processing unit 32, which synthesizes the processed summation data signal fs therefrom. This has a particularly high signal-to-noise ratio and can therefore be decoded in a particularly error-free manner in the demodulator 33.

To explain this situation, on the one hand, the equal-sized, bubble-shaped field lines Ca...Cd from figure 1 are represented in the detection area 1 in figure 2a by broken lines and, on the other hand, the field lines Cga...Cgd, which are produced as a result of weighting, are represented by continuous lines. Since the reception of data signals of the mobile data memory MDS increasingly deteriorates from the antenna d1 to the antenna a1 due to the distance relationships, the antenna signal of the antenna d1, for example, is evaluated as particularly strong and the antenna signal of the antenna a1 is evaluated as particularly weak. This causes an apparent swelling or shrinking of the field lines Cga...Cgd compared with the original conditions Ca...Cd. The weighting thus causes an apparent change in the reception ranges of the antennas a1...d1. If the mobile data memory MDS moves within the detection area, the individual reception characteristics of the antennas apparently change as a result of the re-adjustment, effected by the weighting, of the amplitudes of the individual data signals fga...fgd. The resulting reception characteristic of all antennas thus appears to follow the mobile data memory MDS in its movement along the movement path 2. As already explained above, an arrangement of this type can also be referred to as an "adaptive antenna".

Figure 2b shows, by way of example, the condition of the weighting which is set when the mobile data memory MDS moves. Here, the data memory is located in a position opposite the

receiving locations Pb,…Pc and therefore the antennas b1, c1. The data signals fgb, fgc are amplification-weighted, whereas the data signals fga, fgd are attenuation-weighted. This results in the apparent swelling or shrinking of the reception characteristics Cgb, Cgc and Cga, Cgd shown in figure 2b.

In the example shown in figure 2a, the weighted data signals fgd…fga thus contribute with decreasing weighting to the formation of the processed summation data signal fs. In the example shown in figure 2b, the weighted data signals fgb, fgc contribute accordingly with a higher weighting and the weighted data signals fga, fgd with a lower weighting to the formation of the processed summation data signal fs. On the other hand, the indicator for the direction of movement can also be advantageously defined through evaluation of the data signals weighted with the weighting factors, i.e. adapted. The selectivity of the detection of the direction of movement can also be improved thereby.

Claims

1. A method for detecting the direction of movement of a mobile data memory (MDS) along a movement path (2), characterized in that

a) data signals (fca…fcd) of a mobile data memory (MDS) are detected in at least two different receiving locations (Pa…Pd) along the movement path (2),

b) changes in the data signals (fca…fcd) are compared at the receiving locations (Pa…Pd), and therefrom

c) an indicator (V) is defined for the direction of movement of a mobile data memory (MDS).

2. The method as claimed in claim 1, characterized in that the indicator (V) for the direction of movement is defined through comparison of changes in the received field strengths (Ca…Cd) of data signals (fca…fcd) at the receiving locations (Pa…Pd).

3. The method as claimed in claim 1 or 2, characterized in that through

a) comparison of the received field strengths (Ca…Cd) of the data signals (fca…fcd) at the receiving locations (Pa…Pd), weighting factors (ga…gd) are derived in such a way that

b) a higher or lower weighting factor (ga…gd) is allocated (fga…fgd) to a data signal (fca…fcd) with a stronger or weaker received field strength (Ca…Cd).

4. The method as claimed in claim 3, characterized in that the indicator (V) for the direction of movement is

defined through evaluation of the data signals (fga...fgd) weighted with the weighting factors (ga...gd).

5. The method as claimed in one of the preceding claims, characterized in that the indicator (V) for the direction of movement is defined through comparison of the type of data signals (fca...fcd) at the receiving locations (Pa...Pd).

6. The method as claimed in one of the preceding claims, characterized in that the received data signals (fca...fcd) are decoded and their logical content defined.

7. The method as claimed in claim 6, characterized in that the indicator (V) for the direction of movement is defined through evaluation of the temporal sequence of the logical content of the data signals at the receiving locations (Pa...Pd).

8. The method as claimed in claim 6 or 7, characterized in that the logical content of the data signals (fca...fcd) is allocated to mobile data memories (MDS).

9. A device to carry out the method as claimed in one of the preceding claims, characterized by an adaptive receiver device (3) with

a) at least two antennas (a1...d1) at least for the reception of data signals (fza...fzd), which are disposed along the movement path (2) of a mobile data memory (MDS), and with

b) an evaluation unit (31), which is connected to the antennas (a1...d1) and which defines an indicator (V) for the direction of movement of a mobile data memory (MDS) from the data signals (fza...fzd).

10. The device as claimed in claim 9, characterized by a transceiver device for two-way exchange of data signals with

mobile data memories (MDS), which contains the adaptive receiver device (3).

11. The device as claimed in claim 9 or 10, characterized by antennas (a1...d1) whose radiation diagrams are aligned and focused as accurately as possible along the movement path (2) of mobile data memories (MDS).

12. The device as claimed in claim 11, characterized in that the radiation diagrams of the antennas (a1...d1) have an overlap in relation to one another which is as limited as possible.

13. The use of a method as claimed in one of claims 1 to 8 in an identification system which at least has mobile data memories (MDS) attached to mobile goods, whereby data characterizing the respective goods are stored in a mobile data memory (MDS).

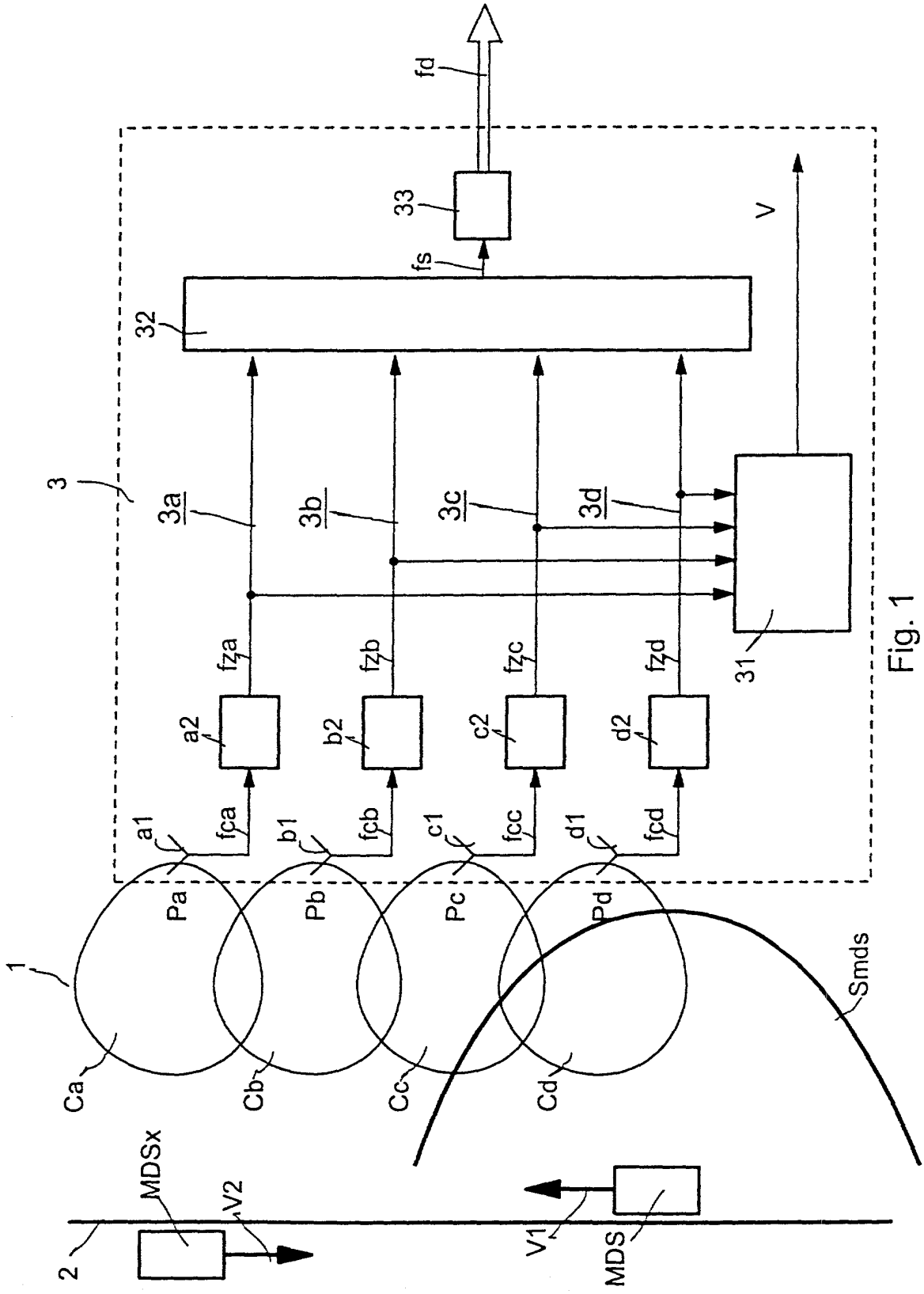
14. The use of a device as claimed in one of claims 9 to 12 in an identification system which at least has mobile data memories (MDS) attached to mobile goods, whereby data characterizing the respective goods are stored in a mobile data memory (MDS).

Abstract

Method and device for detecting the direction of movement of a mobile data memory, particularly in an identification system

In at least two different receiving locations (Pa…Pd) along the movement path (2) of a mobile data memory (MDS), data signals (fca…fcd) of the data memory are detected, the changes in the data signals relative to the receiving locations are compared, and an indicator (V) for the direction of movement is defined therefrom. The indicator is advantageously defined through comparison of the received field strengths or the temporal sequence of the logical content or the type of the data signals at the receiving locations.

FIG 1


fd
33
fs
32
V
3
3a
3b
3c
3d
fza
fzb
fzc
fzd
31
a2
b2
c2
d2
a1
b1
c1
d1
fca
fcb
fcc
fcd
Pa
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Pc
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Smds
Ca
Cb
Cc
Cd
MDSx
V2
2
V1
MDS

Fig. 1

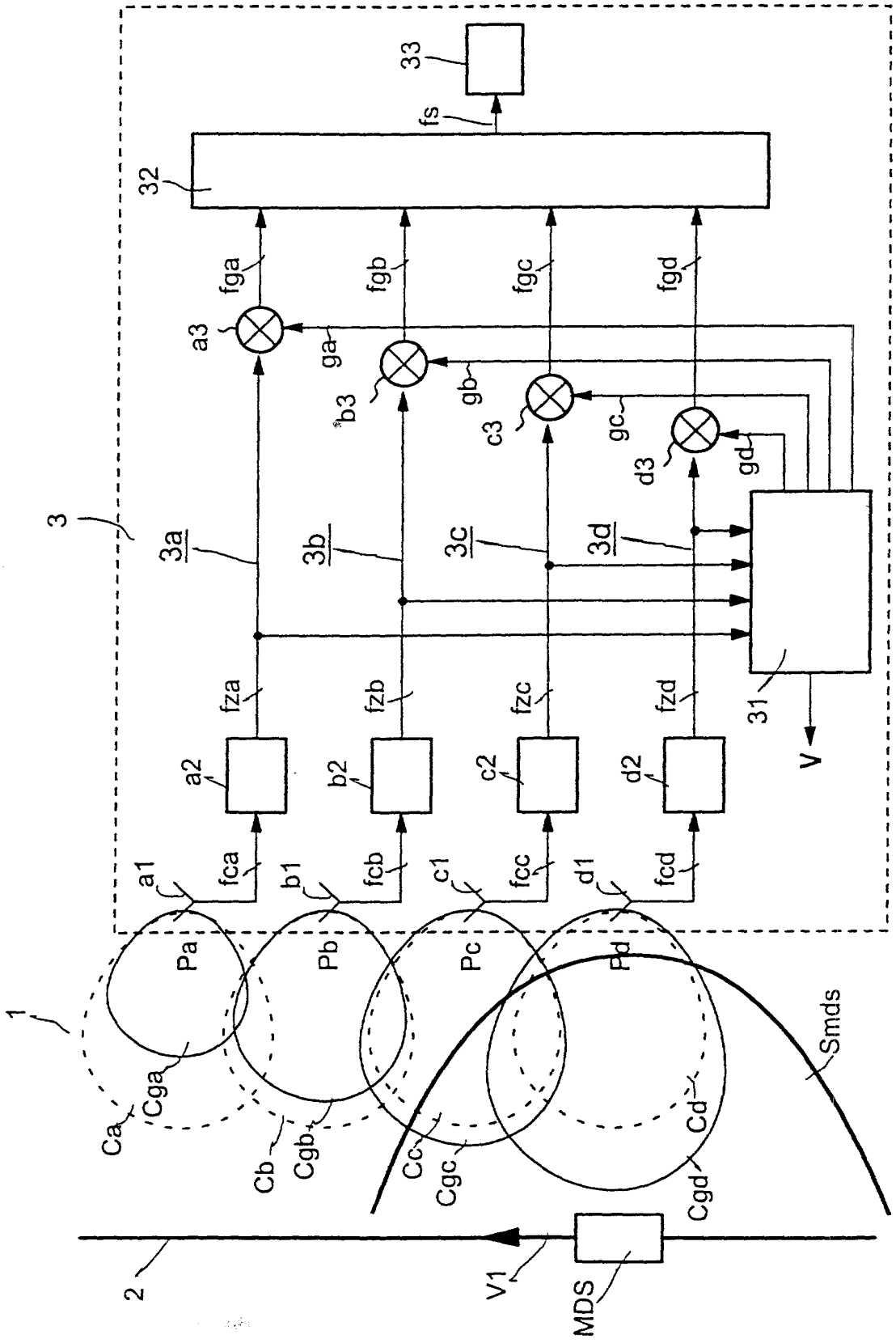

Fig. 2a

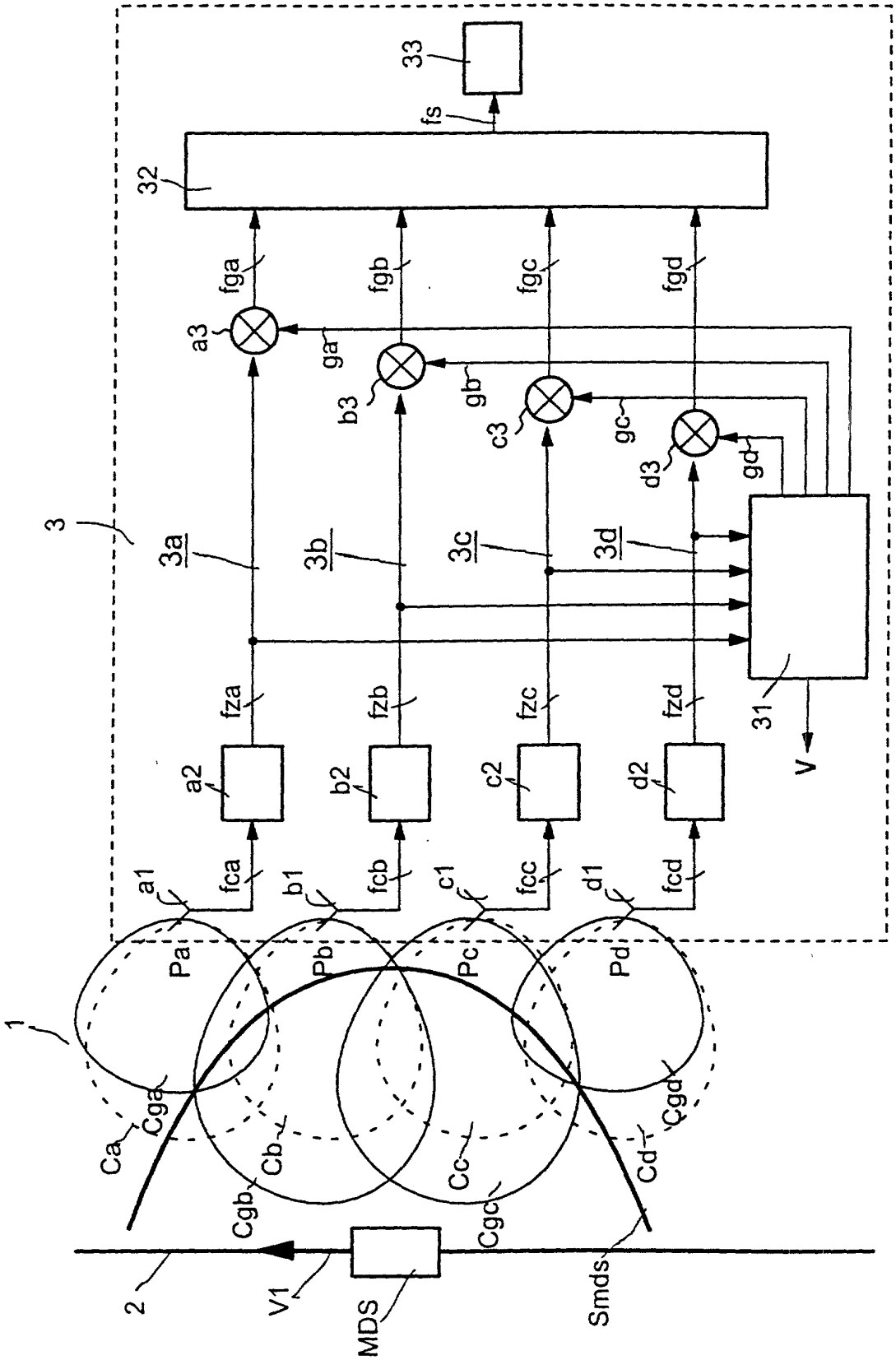
33
fs
32
fga
fgb
fgc
fgd
a3
ga
b3
gb
c3
gc
d3
gd
3
3a
3b
3c
3d
fza
fzb
fzc
fzd
31
V
a2
b2
c2
d2
fca
fcb
fcc
fcd
a1
b1
c1
d1
Pa
Pb
Pc
Pd
1
Ca
Cga
Cb
Cgb
Cc
Cgc
Cd
Cgd
2
V1
MDS
Smds

Fig. 2b

Declaration and Power of Attorney For Patent Application

Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren und Vorrichtung zur Erfassung der Bewegungsrichtung eines mobilen Datenspeichers insbesondere bei einem Identifikationssystem

Method and device for detecting the direction of movement of a mobile data memory, especially in an identification system

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)
☐ hier beigefügt ist.
☒ am __als
PCT internationale Anmeldung
PCT Anmeldungsnummer _____
eingereicht wurde und am _____
abgeändert wurde (falls tatsächlich abgeändert).

(check one)
☐ is attached hereto.
☒ was filed on _____ as
PCT international application
PCT Application No. _____
and was amended on _____
(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

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German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
19929496.8 (Number, Nummer)	DE (Country, Land)	28.06.1999 (Day Month Year Filed, Tag Monat Jahr eingereicht)	☒ Yes Ja	☐ No Nein
(Number, Nummer)	(Country, Land)	(Day Month Year Filed, Tag Monat Jahr eingereicht)	☐ Yes Ja	☐ No Nein
(Number, Nummer)	(Country, Land)	(Day Month Year Filed, Tag Monat Jahr eingereicht)	☐ Yes Ja	☐ No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D, M, Y) (Anmeldedatum T, M, J)	(Status) (patentiert, anhängig, aufgegeben)	pending (Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt: *(Name und Registrationsnummer anführen)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

Customer No. 21003

And I hereby appoint

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Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

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